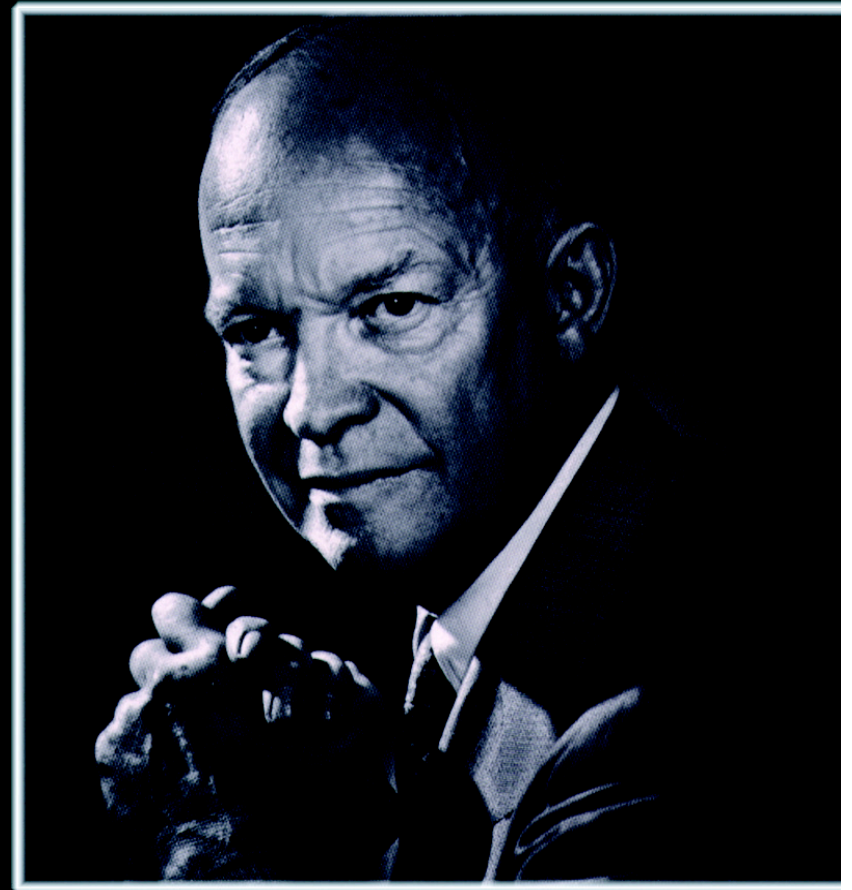
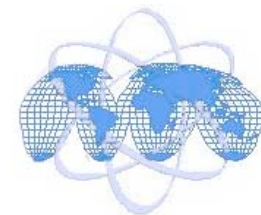


Atoms for Peace After 50 Years: The New Challenges and Opportunities

July 2003

**"...to serve the needs rather
than the fears of mankind."**

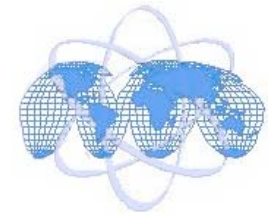




Report Development

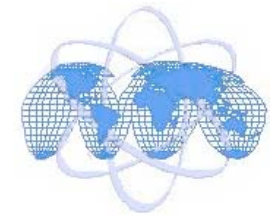
Participant Inputs Status and Roadmap

Bob Schock - July 23, 2003



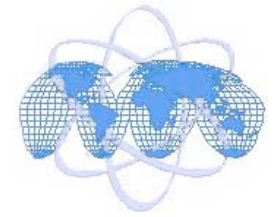
Personal Observations

- **My task is to stimulate the discussions here and on the web.**
- **Many enthusiastic inputs, all very thoughtful, many enlightening, all will impact the report (sense some are holding back - need alternative views and reasons)**
- **Some of you were offended -**
 - **We succeeded in drawing out non-U.S. centric views**
- **In rush for writers and the editor to get Draft 3 out, some comments have been accounted for, others not yet**
- **For same reason, redundancy will be removed, shortening report**
- **Additional meetings (e.g., Japan, ?)**



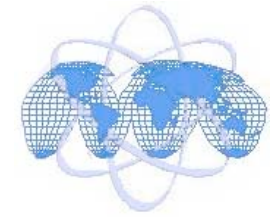
Schedule

- **August 25 - Draft 4.0**
- **September 4 - D.C. Conference (chairs)**
- **November 13-14 - Final Meeting & Draft, LLNL**
- **November 17 - Special Global 2003 ANS Session, New Orleans**
- **December 8-9 - LANL/Wilson Center, D.C.**



General Comments

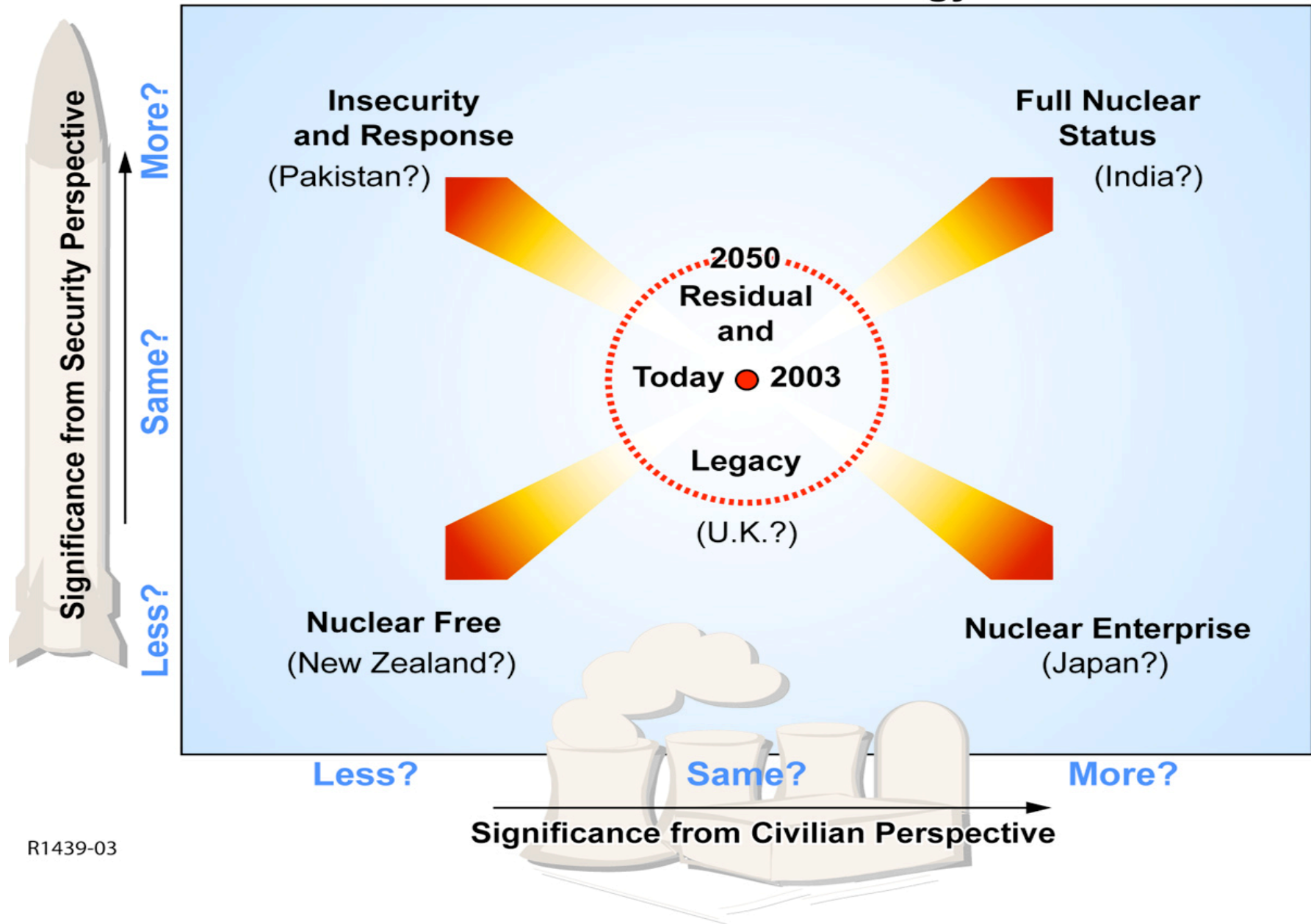
- **Housekeeping**
 - ✓ History is getting in way of the “meat” of the subject (Moved to Appendix)
 - ✓ Change the time breaks for history
 - Go with decades (impartial)
 - ✓ Need glossary of terms
 - ✓ Need to be clear whether fact or speculation



Organization of Future Sections (VI & VII)

- **Fundamental Forces → Underlying Theses**
- **Identify Fundamental Driving Forces**
 - For each of 5 general directions
 - More S - More C; More S - Less C; More C - Less S; Less S - Less C; Same. # [put a survey on website]
 - Include facts, factoids, sub-driving forces, uncertainties (incl. disagreements), transforming events
 - Leading to identification of leveraging factors for change & “Actions to Better Understand and/or Shape the Future”

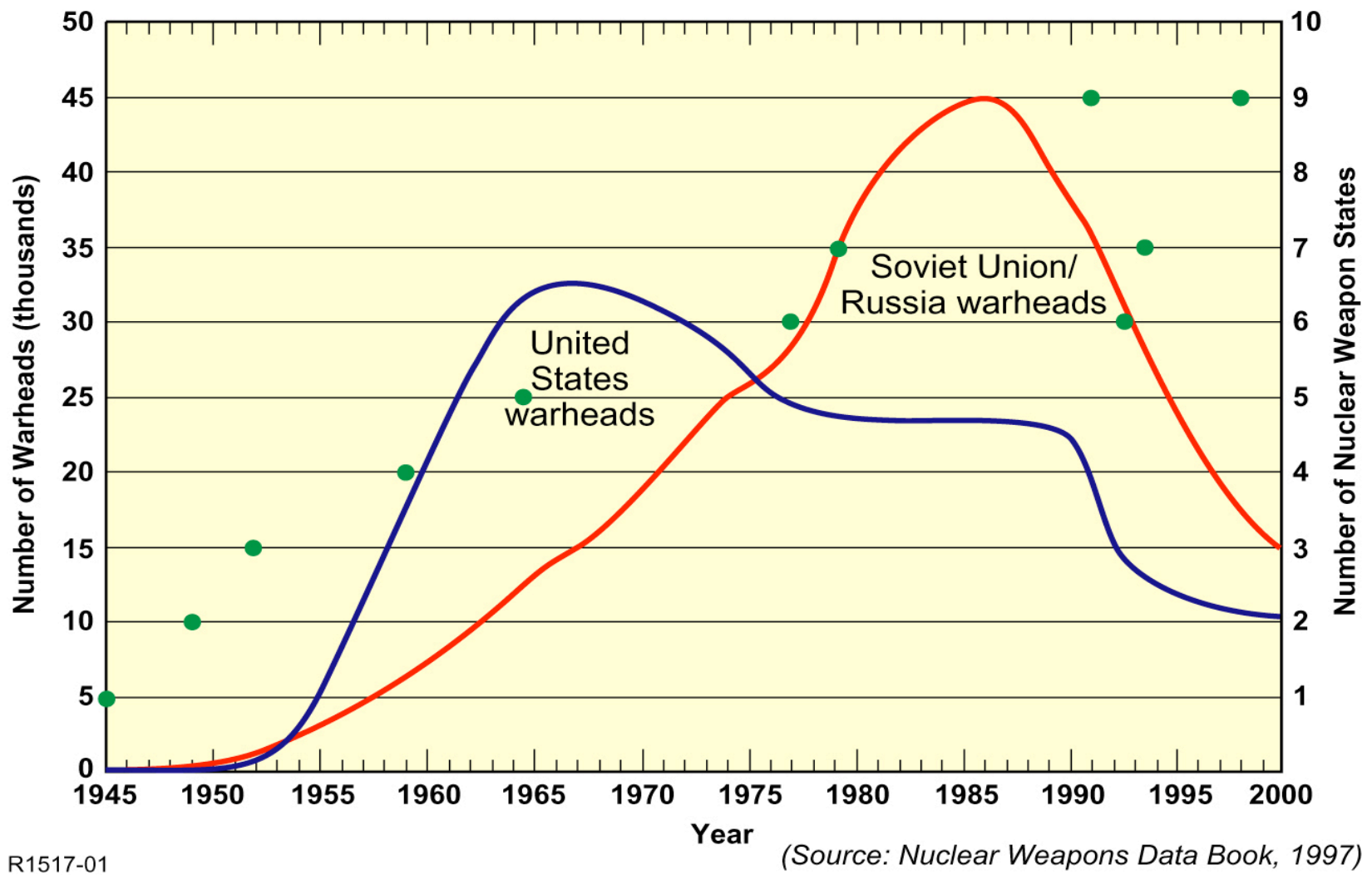
Alternative Nuclear Technology Futures

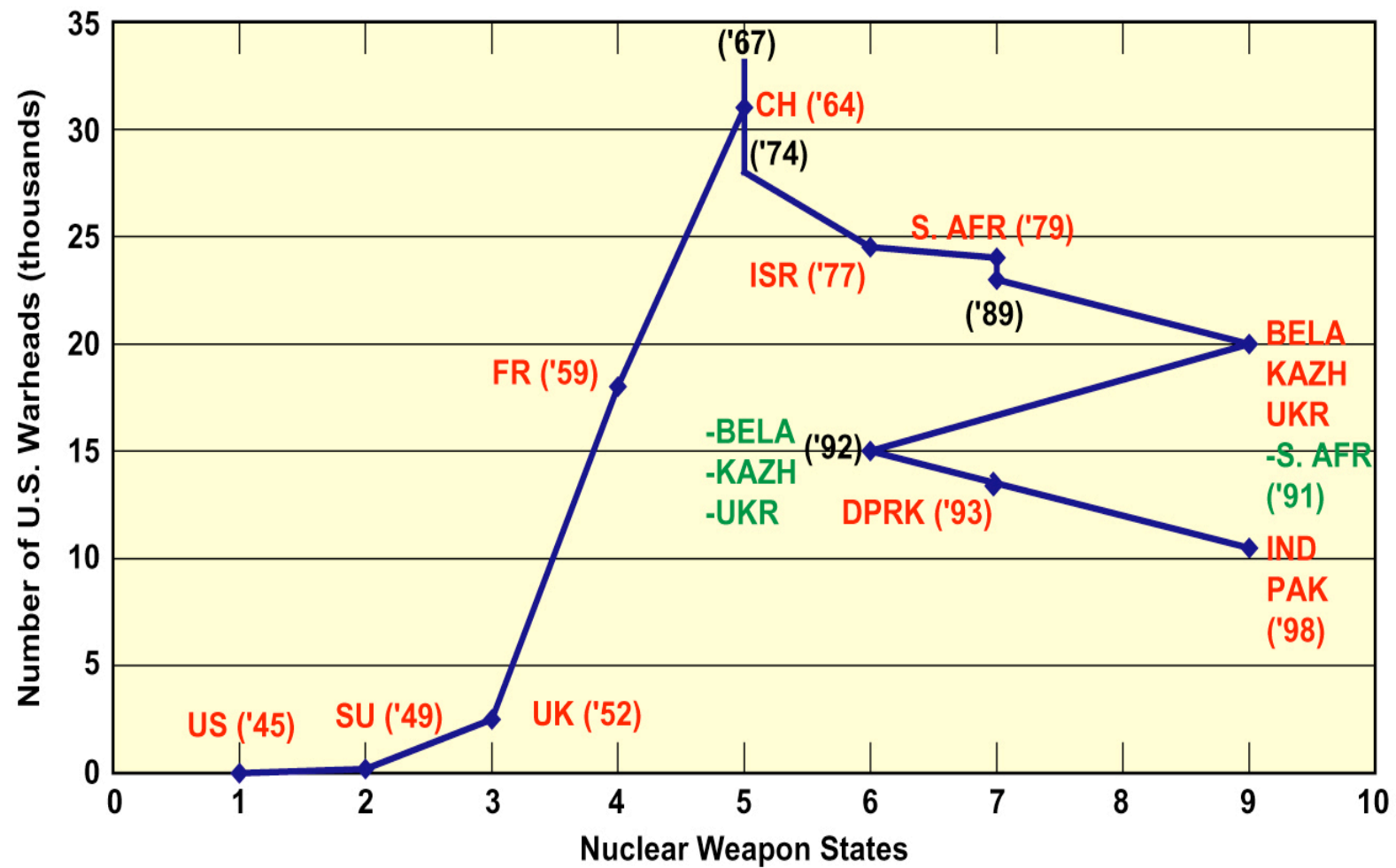




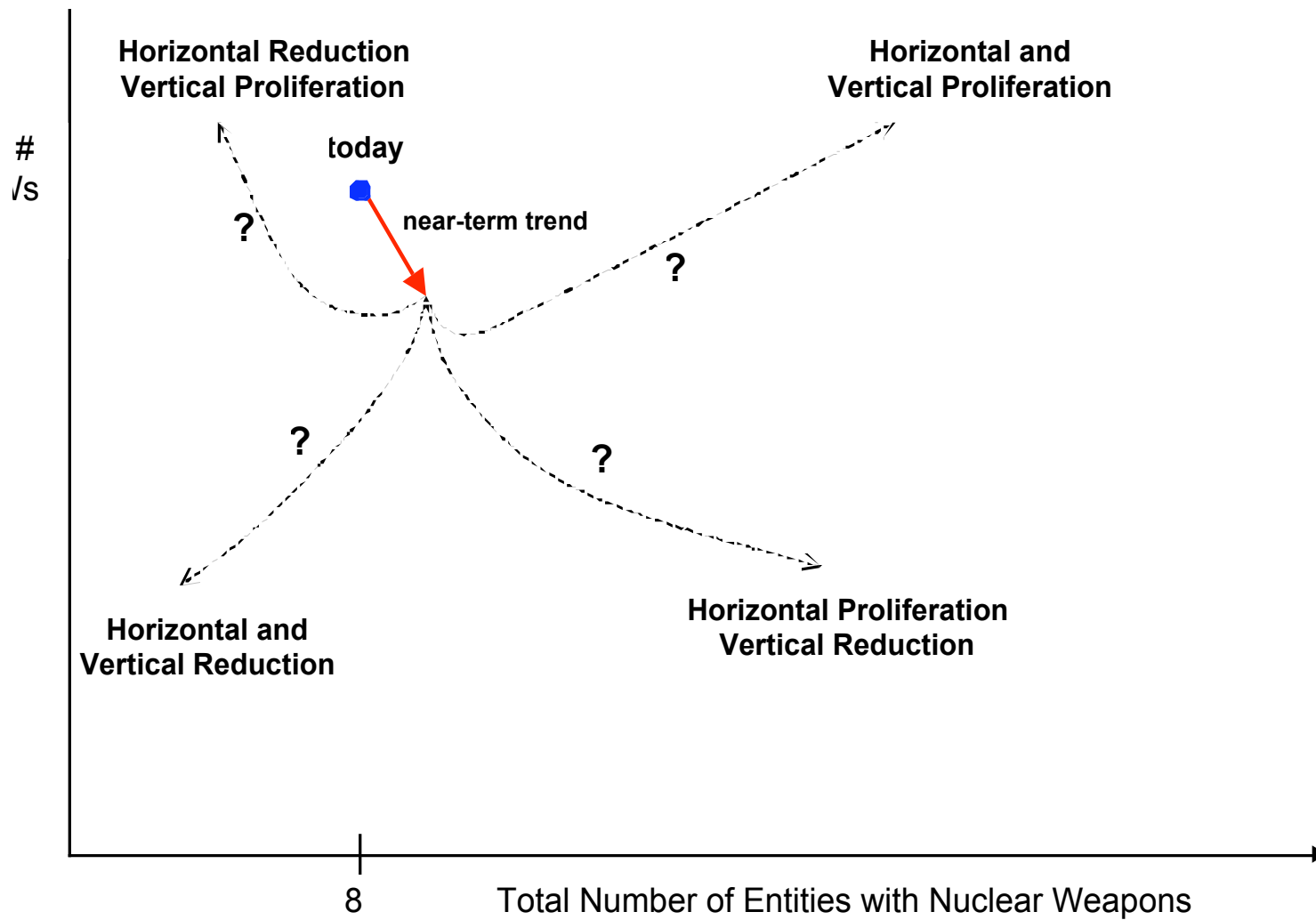
Thesis - I

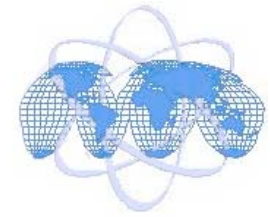
- **I - Some will always desire weapons (nations and sub-national)**
 - **Sub-forces ➔ Drivers (More or Less S)**
 - Desire to thwart outside intervention
 - Seeming inability to accept changing technology for S&S - NNWS/NPT signers can avoid detection of military program
 - Continued US role (assure allies, dissuade competitors, deter aggressors, defeat enemies)
 - NWs viewed by terrorists as first choice, not last resort
 - **Facts ##**





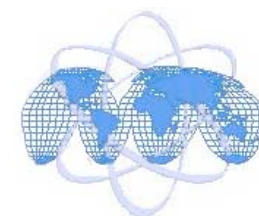
(Source: Nuclear Weapons Data Book, 1997; Albright, 2000; Reiss, 1995)





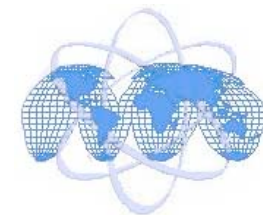
Comments on I

- I - Some countries will always desire nuclear weapons, as may an increasing number of sub-national groups
 - Comment(✓) - list categories by NW Programs: P-5, Other known (4), Thought to Have (1), Have Had (9)
 - ✓ - “..... desire in the foreseeable future ...”
 - ✓ - sub-driver - indications that threat from sub-national groups has increased in recent years
 - ✓ - **chemical & some conventional munitions are proven WMD (cluster bombs)**
 - ✓ - **Add obligation of NWS under Article VI (mentioned in History)**
 - ✓ - Is “on short notice” justified given Iraq experience



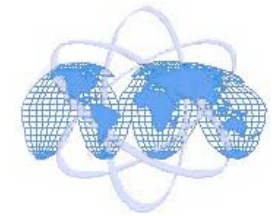
Thesis II

- **II - Substantial and growing S & C material**
 - **Drivers (More or Less S &/or C)**
 - Lack of international consensus on disposition of material
 - Lack of discussion of global perspective
 - HEU is difficult to track and easy to use
 - 10,000 Mt of new spent fuel per year
 - Spent fuel is less self-protecting with time



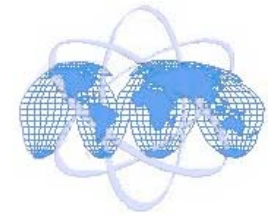
Comments on II

- ✓ - less hazard when spent fuel is underground
- ✓ - **U^{235} is not a product of the reactor cycle (fuel cycle)**
- ✓ - Burying spent fuel creates a potential mine for fissionable material
- ✓ - Difficulty of passively detecting HEU and ease of use in a nuclear weapon
- ✓ - Elaborate the research reactor Table to include HEU < 90% & shutdown reactors with on-site spent fuel
- ✓ - SF is not self-protecting for suicidal terrorists
- ✓ - **Differentiate the US and Russian efforts to reduce stockpiles and slow progress to reduce weapons usable Pu/HEU**



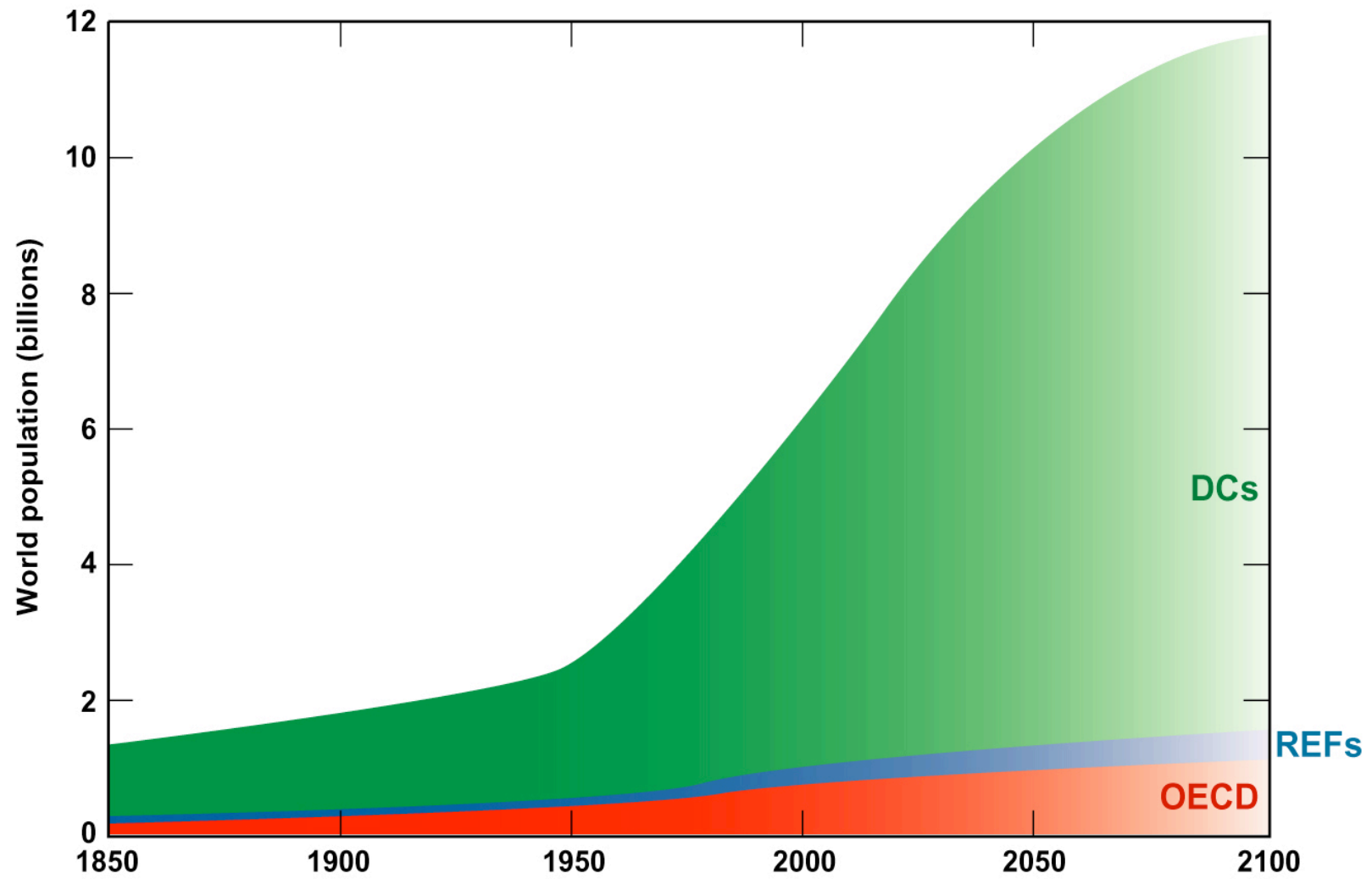
Thesis III

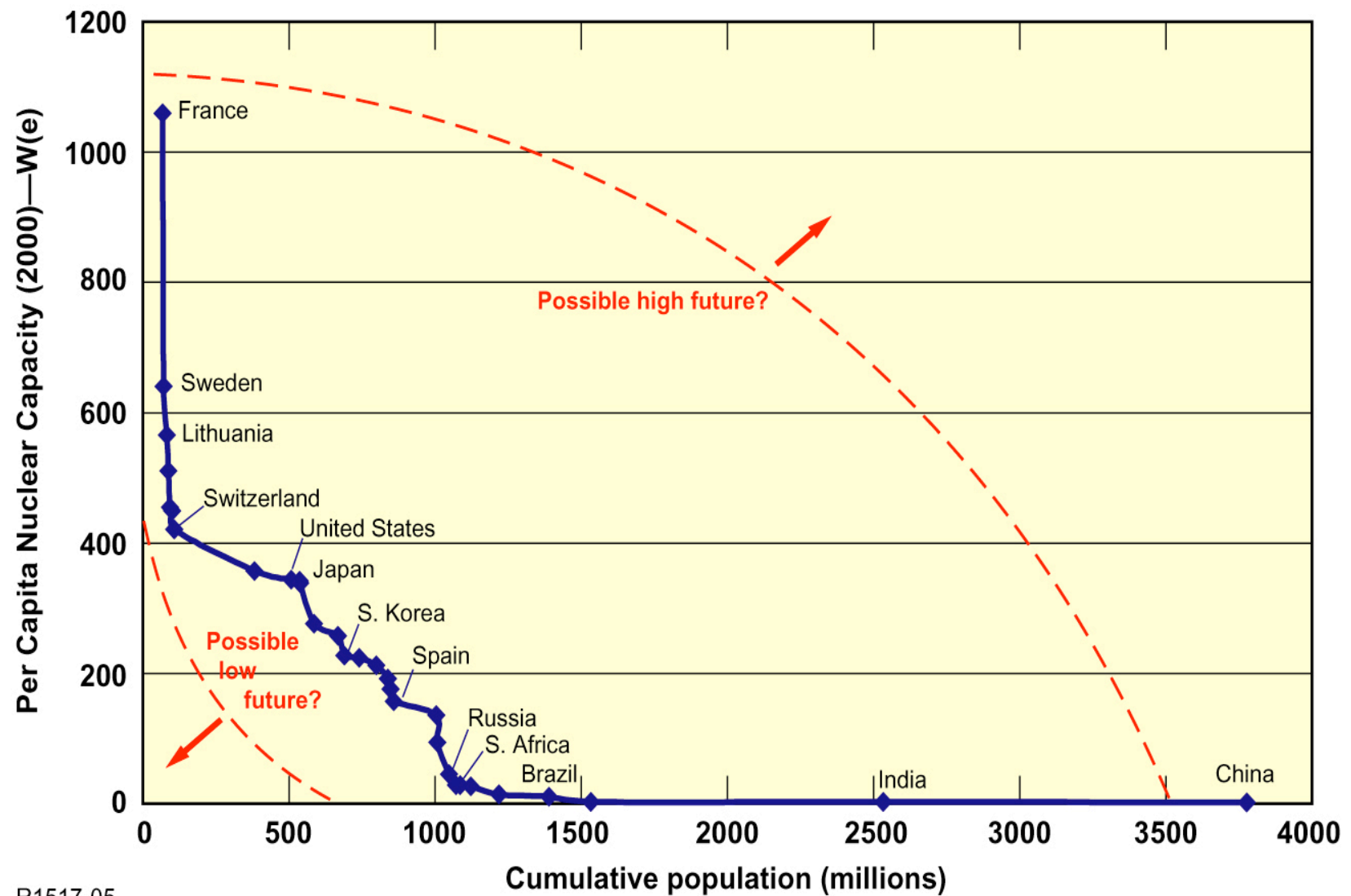
- **III - SKA (including technology) to make nuclear weapons is available to anyone & skills to utilize this knowledge is becoming more pervasive**
 - **Drivers (More or Same S, Same or Less C)**
 - Knowledge will always expand to more and more people
 - Speed and memory of lap-tops (let alone parallel lap-tops) are comparable to CRAY-2 (1985)
 - Computer codes useful for modeling NWs are commercially available
 - Technical information widely available
 - SKA to thwart NW production also increases



Thesis IV

- **IV - Nuclear power produces almost no greenhouse gases etc.**
 - **Drivers (More, Same or Less C)**
 - World seems destined to try to control carbon dioxide emissions (and regional air pollution)
 - Nuclear power is further along the technology development path than other non-fossil competitors
 - Current nuclear power is not where the populations are
 - There is a lot of fossil fuel and a robust industry to find ways to sequester carbon dioxide
 - No nuclear fuel cycle is proliferation proof
 - Population growth and SOL in Developing World
 - Uncertainty about cost
 - Public not swayed that nuclear will solve climate change

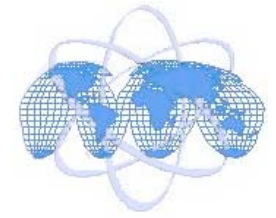




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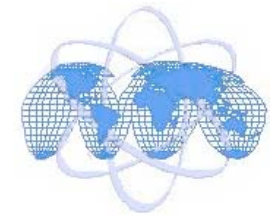
(Data Source: U.S. EIA, 2002)

.... public not swayed that nuclear power will solve global warming (J.Ahearne)



Comments on IV

- ✓ - nuclear power is not the preferred substitute for fossil power
- ✓ - fusion? (40+ years to significantly impact market)
- ✓ - nuclear power future is dependent on both real and perceived status of waste disposition
- ✓ - safety also a public concern



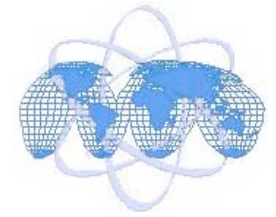
Thesis V

- **V - Non-power civilian uses are large & growing**
 - **Sub-drivers (Same or More C)**
 - Widespread use of medical (therapy & diagnoses)
 - Radioisotope space power vital to C & M
 - More food poisoning leads to greater awareness of benefits
 - Agricultural uses of radiation a very large business
 - Industrial uses (measurements, inspections, process control) wide and growing



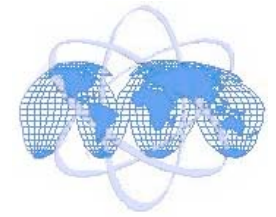
Comments on V

- ✓ - disposal for non-fuel cycle wastes needs attention



Suggested New Thesis

- **Commercial Forces will drive the direction of civilian nuclear technology**



General comments/suggestions

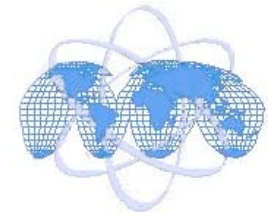
- **Several comments on 1979 Vela satellite**
- **Finland is leading on waste management**
- **Need for a global framework for licensing & regulation?**
- **Uranium resources need updating (new)**
- **New treaty prohibiting enrichment & reprocessing outside of P5 (N8)?**
- **More neutral on commitments (CTBT)**
- **US should aggressively pursue elimination of HEU in research reactors and all “critical facilities”**



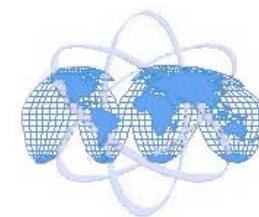
Comments - Suggestions (cont'd)

- Role of intelligence gathering is critical, but sharing has been problematic
- Reference statement that some NNWSs are cheating
-international system to minimize nuclear terrorism and its consequences.....
- Lump Israel with Pakistan and India, not DPRK and Iran
- Create a “Nuclear Information Centre” to transparently present facts

Comments - Suggestions (cont'd)



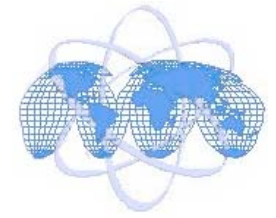
- **Correct Swiss “questioning reliance on nuclear power” (May 18, 2003)**
- **Change SNM to weapons usable material**
- **Reference the 13 steps to nuclear disarmament agreed to at the 2000 NPT Review Conference**



Survey



We asked questions comparing future significance of security and civilian nuclear technologies - 2010, 2020, 2050

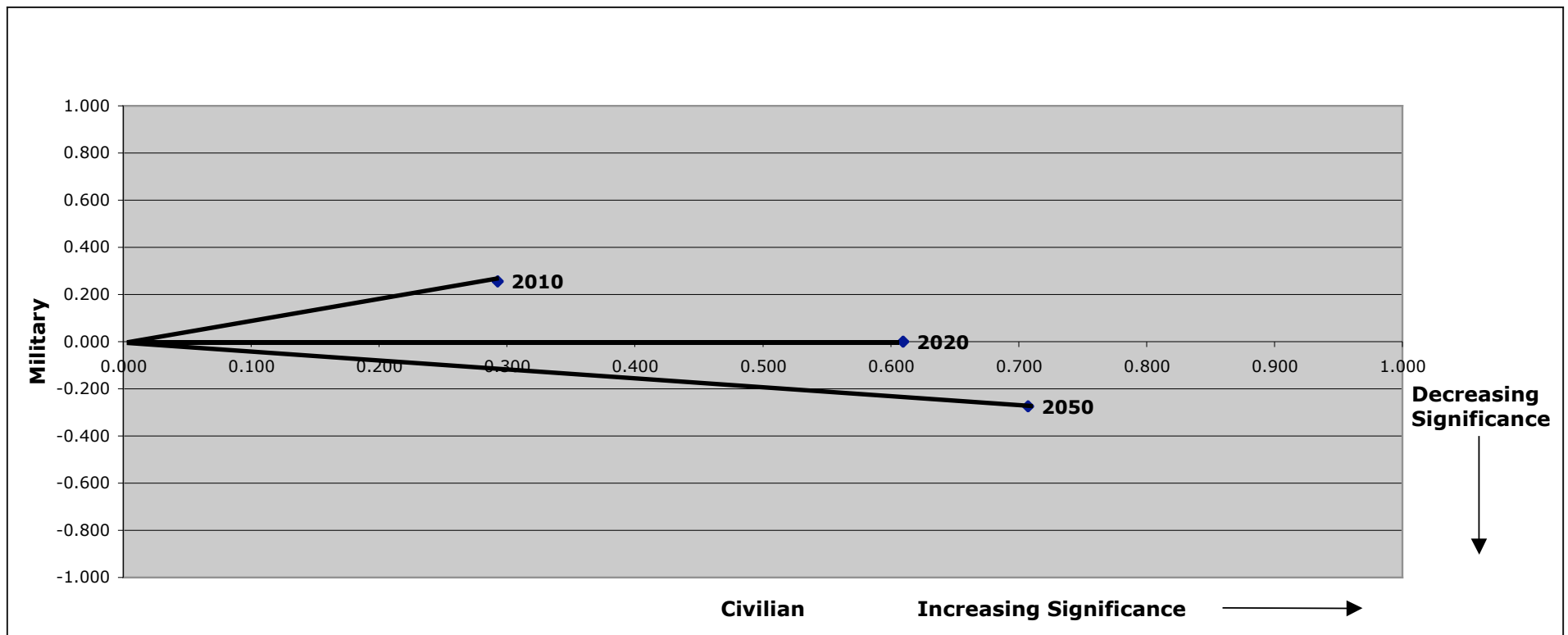
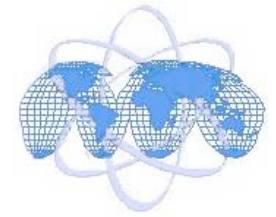


- Globally
 - What could happen? (analytical)
 - What should happen? (normative)
 - What will happen? (predictive)
- Regionally
 - What will be the significance of S & C in:
 - EU
 - US
 - New Zealand
 - DPRK
 - Russia
 - China
 - Iran
 - India
 - Japan
 - Brazil
 - South Africa
- 41/~180 respondents



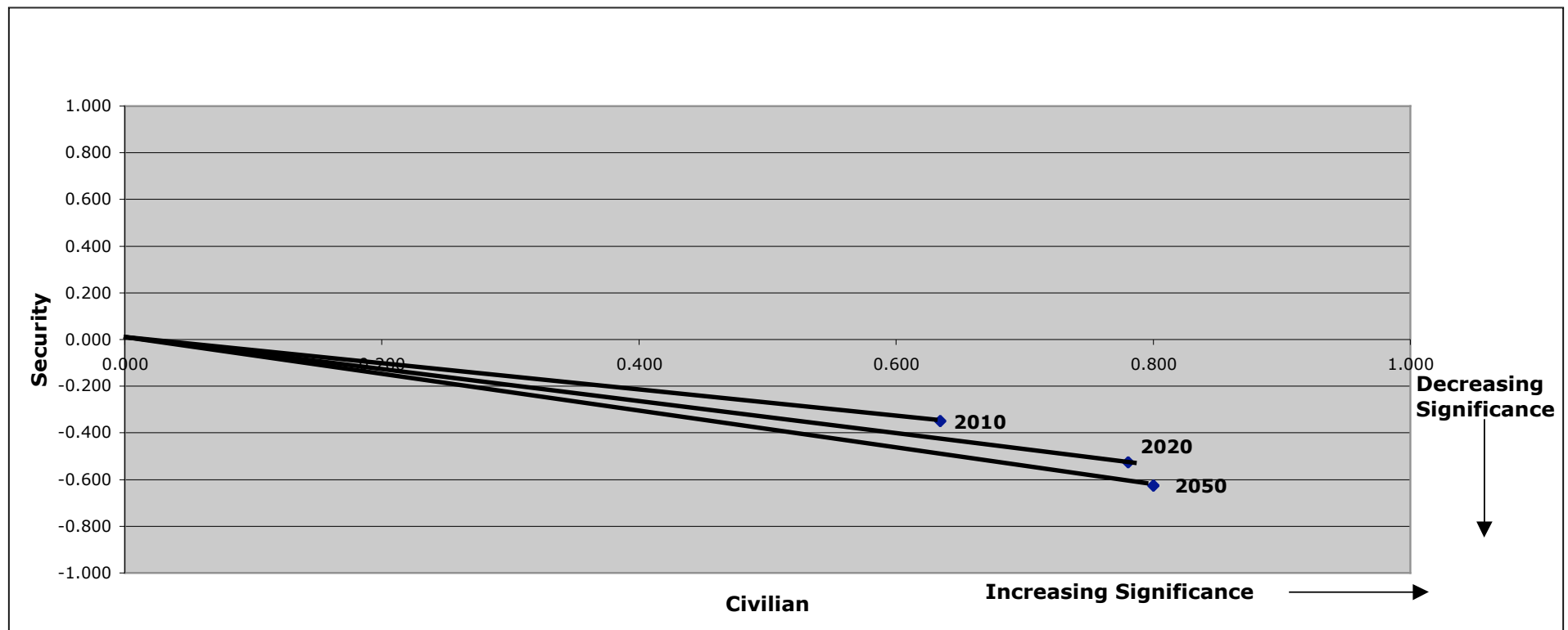
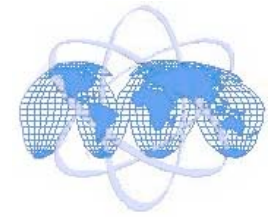


Globally - What could happen?



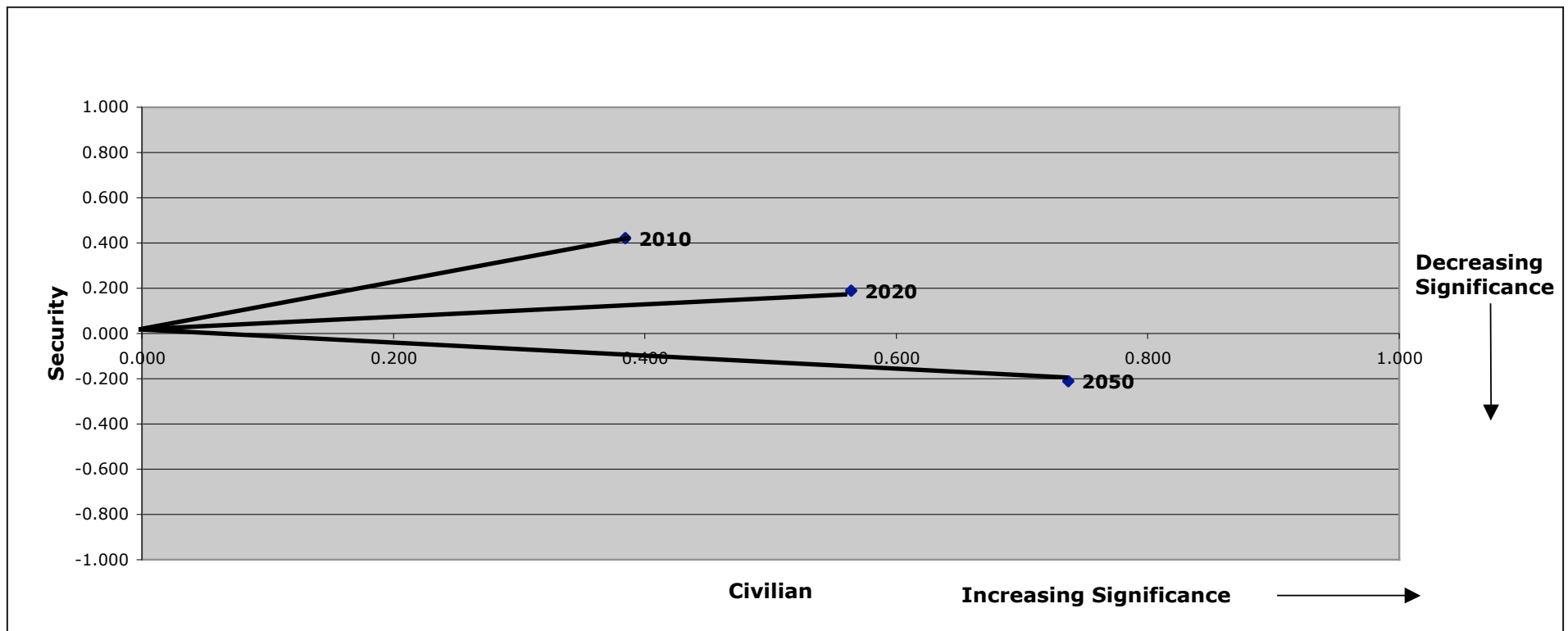
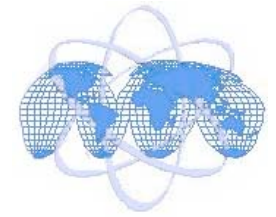


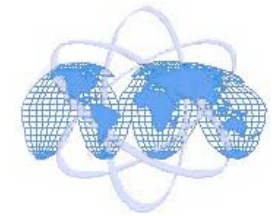
Globally - What should happen?



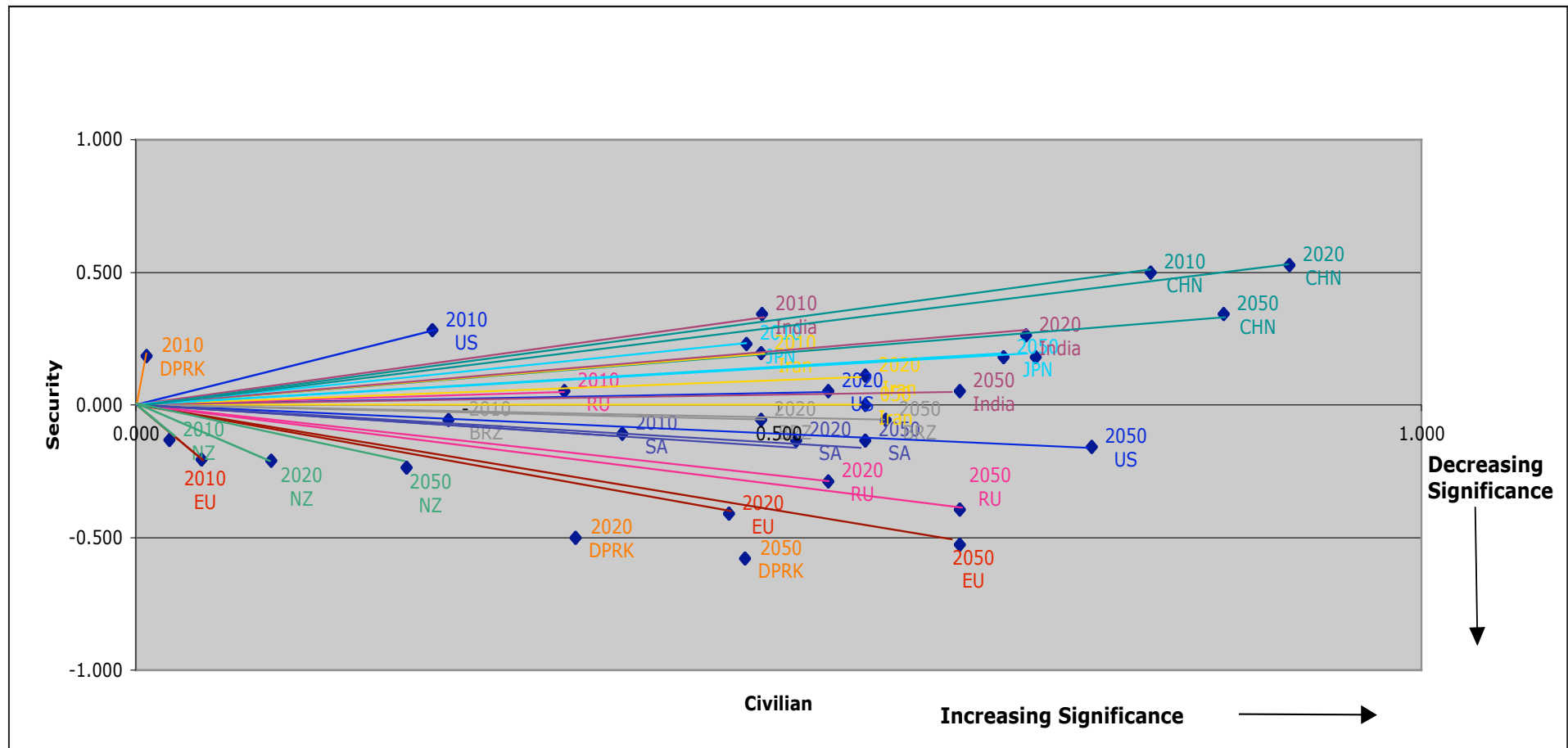


Globally - What will happen?

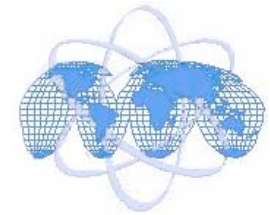




Country by Country - What will be the significance...?



What does this mean?



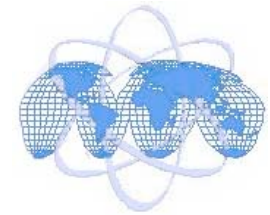
- General agreement that we should have
 - An increase in the importance of civilian nuclear technologies, accompanied by a decrease in the importance of nuclear weapons
- However, most believe that over the next 50 years
 - The importance of nuclear weapons will only decrease by a small amount and
 - The significance of nuclear technology will increase by a small amount

How do we go from what we believe will happen to what we believe should happen?



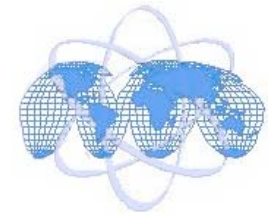
But a “one size fits all” approach will not be sufficient

- **While most believe there will be an increase in the importance of nuclear power in Japan, China, India and Iran, there remains concern over the comparative importance of nuclear weapons and the associated risk of proliferation**
 - **Does a nuclear deterrent necessarily mean increased risk of proliferation?**



Actions to: Better Understand &/or Shape the Future

- **As a result of changes in technology and the spread of knowledge and weapons, examine an evolving international regime that builds on the successes of the NPT (& 2000 NPT Review) but charts a course that incorporates new realities into the future (additional protocol)**
 - **Issues include:**
 - **Handling of Enforcement**
 - **Terrorist Groups**
 - **Materials (incl. HEU in civilian cycle; universality; P5+)**
 - **Real & perceived intent of Article VI - requirements of NNWSs**
 - **New P & PR technologies (now and future)**
 - **Deal with current non-NPT NWSs (P3)**



Actions (cont'd)

- **Need a thorough balanced international analysis of once-through and recycle considering economics (incl. U supply), proliferation, safety, environmental impacts, time-frames (energy)**
 - **Lacking this the public, policymakers (and those interested) will remain confused (necessary but not sufficient - communicating the risks and benefits)#**
- **Need to engage the public in dialogue - get the science right first and then use the right science - don't let scientists do it all**

Before final, obtain China (& India) comment on draft

U.S. Generating Capacity Capital Costs

